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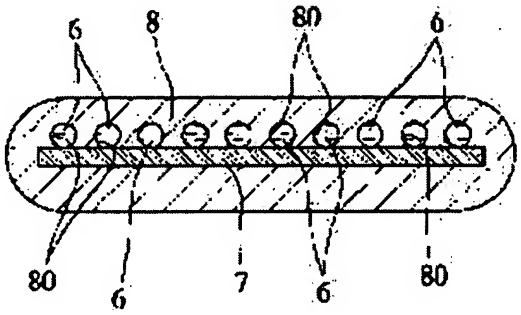
(54) OPTICAL FIBER CONNECTING PART, ITS MANUFACTURING METHOD AND DEVICE, AND PRODUCT EQUIPPED WITH SUCH PART

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an optical fiber connecting part having fine holes, its manufacturing method and device, and a product equipped with such part.

SOLUTION: The optical fiber connecting part 8 has the inserting holes 80 formed by adjacently arranging insulated fine wires 6,..., in the conductor part 7, covering the conductor part 7 as well as the insulated fine wires 6 with a metal precipitated by electroforming, and then removing the insulated fine wires 6.



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* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Generally, this invention relates to the product equipped with the component which has micropore, its manufacture approach, a manufacturing installation, and the above-mentioned components, and relates to the product specifically equipped with the coupling parts for optical fibers, its manufacture approach, a manufacturing installation, and the coupling parts for optical fibers.
[0002]
[Description of the Prior Art] There are the approach of connecting possible [desorption] using an optical connecter and the approach of connecting eternally in connection of an optical fiber. Furthermore, after aligning the edge of an optical fiber with the components for alignment, there are fusion splicing which carries out heating weld, and a mechanical splice pasted up or stuck by pressure in a splice.
[0003] The interior of an optical connecter is equipped with the ferrule for holding so that it may not shift in the location which had one end of an optical fiber decided at the time of connection. The ferrule consists of a capillary currently formed in the shape of a cylindrical shape, and a flange which supports a capillary. The insertion hole which inserts an optical fiber in the cross-section core of a capillary is penetrated and drilled in the die-length direction. The optical fiber is inserted and introduced in the insertion hole so that an edge may become the end face and abbreviation flush of a capillary.
[0004] The alignment adapter for comparing and holding an optical fiber is used for connection of an optical connecter. An optical connecter is connected by inserting and comparing a capillary from both sides in the above-mentioned alignment adapter.
[0005] The core whose outer diameter along which light (information) passes is about 0.010mm is prepared in the interior at the optical fiber. With an optical fiber, since it is transmitted while light reflects inside a core, a core must be connected in the condition of having compared with high precision. Therefore, exact dimensional accuracy is demanded of the capillary. Conventionally, the thing of a capillary made from a zirconia ceramic is common.
[0006] The capillary made from a zirconia ceramic is built as follows. First, metal thin line material slushes the zirconia powder used as a raw material in the metal mold with which it is become tense, and fabricates a cylinder object. Next, the fabricated cylinder object is calcinated at about 1200-degree C elevated temperature. And diamond paste is poured to the insertion hole of the calcinated cylinder object, and the interior is ground, and it finishes so that an aperture may have a predetermined dimension. Finally, the periphery section of a cylinder object is ground and a perfect circle form is made so that an insertion hole may be located at the core of a cross section.
[0007] A welding connector is used for fusion splicing among splices. The components for alignment made from the ceramic for comparing the core of an optical fiber with high precision are prepared in the welding connector. The V groove for guiding and positioning an optical fiber is formed in the components for alignment. Fusion splicing is connected by putting an optical fiber on V Mizogami of the components for alignment, showing around so that a core may poke each other with high precision, heating a connection in this condition, and fusing an optical fiber.
[0008] A mechanical splice inserts the edge of an optical fiber from both sides in the components for alignment, and compares the core of each other with high precision inside this component for alignment. And an optical fiber is pasted up or stuck by pressure in this condition, and it connects by fixing with the components for alignment.
[0009]
[Problem(s) to be Solved by the Invention] However, there were the following technical problems in the above-mentioned components for optical connecters.
- Since -(1) capillary was built with the zirconia ceramic in the case of the optical connecter, the shaping equipment and

metal mold for fabricating zirconia powder were required for manufacture of a capillary. Since metal mold is chiefly manufactured as a supply, generally it is expensive.
[0010] (2) The baking equipment for calcinating the fabricated cylinder object was required. Moreover, in order to calcinate at the elevated temperature of 1200 degrees C, the resource for obtaining this heat energy is also required. Furthermore, since metal mold was also heated at an elevated temperature, expansion deformation was carried out and prolonged use was not able to be borne.
[0011] (3) Since the cylinder object made from a zirconia ceramic deforms by baking, the process which grinds an insertion hole with diamond paste and makes a predetermined dimension to an aperture is required. Since an operator's advanced workmanship was required and this polish activity was done manually, it was what requires time and effort and time amount. Furthermore, since the zirconia ceramic had the high degree of hardness, the check and the crack might produce it during polish. That is, the conventional capillary was not suitable for mass production, and its productivity was low.
[0012] (4) Since the capillary made from a zirconia ceramic was not easy to manufacture as described above, the ferrule made from a zirconia ceramic with which the capillary and the flange were united was not able to be manufactured as a matter of fact. Therefore, the ferrule attached the metal flange in the capillary made from a zirconia ceramic, and was constituted. That is, the equipment and time and effort which cut a flange in a predetermined configuration by machining other than manufacture of a capillary, and manufacture it were also required. Moreover, the time and effort which assembles a capillary and a flange was also required.
[0013] (5) The former to a certain capillary has that in use in which the insertion hole which inserts in an optical fiber is formed only for one. Hereafter, an insertion hole calls a "multicore type" that by which two or more formation of "1 Heart type" and the insertion hole is carried out in that in which only one is formed in this way. Recent years require the capillary of a 2 heart type or the multicore type beyond it with increase-izing of amount of information in addition to the thing of a 1 heart type. However, in the conventional capillary, in order advanced workmanship is needed manufacturing and to also take time and effort seriously, manufacture of such a capillary is difficult as a matter of fact. Therefore, it is common to install two or more optical connecters equipped with the capillary of a 1 heart type in this case. However, now, the technical problem that a connector will be enlarged occurred.
[0014] - the case of the fusion splicing which is a splice, or a mechanical splice - (6) -- the components for alignment for comparing a core with high precision could not manufacture easily, but since productivity was low, the technical problem were expensive occurred.
[0015] then, in the course which advances research for solving the above-mentioned technical problem, the metallic conduit which has a detailed diameter should build this invention person by deposit of the metal by electrocasting (electroforming) -- its attention was paid to ******. and also build simply coupling parts for optical fibers, such as an optical connecter which was described above by using this, -- ** -- the idea whether to become like was obtained. And research is further repeated based on the idea, and it came to complete this invention.
[0016] The purpose of this invention is to offer the product equipped with the coupling parts for optical fibers which do not need an expensive shaping equipment metallurgy mold, and do not need a lot of energy in manufacture, either, its manufacture approach, a manufacturing installation, and the coupling parts for optical fibers.
[0017] Moreover, an operator is not asked for advanced workmanship in manufacture, but other purposes of this invention can also mitigate the time and effort and time amount concerning manufacture, and are to offer the product equipped with the coupling parts for optical fibers with high productivity suitable for mass production, its manufacture approach, a manufacturing installation, and the coupling parts for optical fibers.
[0018] Furthermore, other purposes of this invention are to offer the product equipped with the coupling parts for optical fibers which can build comparatively easily the thing of a 2 heart type or the multicore type beyond it, its manufacture approach, a manufacturing installation, and the coupling parts for optical fibers.
[0019]
[Means for Solving the Problem] The means of this invention devised in order to attain the above-mentioned purpose is as follows. the metal which deposits by electrocasting if it is in the 1st invention -- a conductor -- they are the coupling parts for optical fibers characterized by having the insertion hole which removed the insulating thin line material covered together with the base material, and was formed.
[0020] if it is in the 2nd invention -- a conductor -- the metal which adjoins or approaches and arranges insulating thin line material to a base material and which deposits by electrocasting -- the above -- a conductor -- it is the manufacture approach of the coupling parts for optical fibers characterized by covering a base material and insulating thin line material, removing the account insulation thin line material of Gokami, and forming an insertion hole.
[0021] the conductor prepared in the cell if it is in the 3rd invention -- the metal with which a base material deposits by

electrocasting -- the above -- a conductor -- it is the manufacturing installation of the coupling parts for optical fibers characterized by adjoining or approaching and arranging insulating thin line material so that it may be covered together with a base material.

[0022] If it is in the 4th invention, it is the product equipped with the coupling parts for optical fibers characterized by tc have the coupling parts of the coupling parts for optical fibers concerning the coupling parts for optical fibers or the 2nd invention concerning the 1st invention for optical fibers manufactured by the manufacturing installation of the coupling parts for optical fibers concerning the coupling parts for optical fibers or the 3rd invention manufactured by the manufacture approach.

[0023] As "coupling parts for optical fibers" as used in the field of this invention, concretely, although a capillary, a ferrule, the components for alignment used at the time of the splice of an optical fiber can be mentioned, it does not limit to these. Moreover, although the optical connecter which used the above-mentioned coupling parts for optical fibers concretely as "a product equipped with the coupling parts for optical fibers" can be mentioned, it does not limit to this.

[0024] this invention is constituted -- "-- a conductor -- base material" is formed with the ingredient with electric good conductivity. Moreover, "the insulating thin line material" which similarly constitutes this invention is usually formed with the nonconductor which is always the very small ingredient of electric conductivity. Moreover, it can also form with the semi-conductor which turns into a conductor and a nonconductor with temperature.

[0025] As the above-mentioned "insulating thin line material", what consists of thermosetting resin, thermoplastics, engineer plastics, and a chemical fiber (a synthetic fiber, a semi-synthetic fiber, a regenerated fiber, inorganic fiber) can be used, for example. For example, phenol resin, a urea resin, melamine resin, diallyl phthalate resin, An unsaturated polyester resin, silicone resin, an epoxy resin, polyethylene, Cross-linked polyethylene, chlorinated polyethylene, ethylene / vinyl acetate copolymer, Polypropylene, a polyisobutylene, a polyvinyl chloride, a polyvinylidene chloride, Polyvinyl alcohol, a polyvinyl acetal, acrylic resin, polyvinyl acetate, A polyacrylonitrile, MODAKURIRU, polystyrene, styrene / acrylonitrile copolymer, Acrylonitrile / butadiene / styrene ternary polymerization object, acetate, Triacetate, a fluororesin, polytetrafluoroethylene, polybutylene terephthalate, Polyarylate, polyacetal, a polycarbonate, a polyphenylene sulfide, Polysulfone, all aromatic polyimide, polyamidoimide, polyether imide, A polyether ether ketone, the poly BENZUU imidazole, polyester, Polyethylene terephthalate, a polyamide, nylon, aramid, polyurethane, spandex, polyalkylene PARAOKISHI benzoate, benzoate, poly fluoro ethylene, a pro mix, rayon, cuprammonium rayon, a glass fiber, etc. can be mentioned.

[0026] "Contiguity" is used as a concept meaning having prepared in the condition of having adjoined each other and contacted by this invention. Moreover, "contiguity" is using contact as a concept meaning being in near, although not carried out.

[0027] As the approach of removal of insulating thin line material, it can draw out and the dissolution by extrusion, the alkali solution, an acidic solution, etc. can be mentioned.

[0028] "Insulating thin line material" can also use what has the deformable property, when it pulls.

[0029] Two or more "insulating thin line material" can also be prepared.

[0030] "Insulating thin line material" can also use what is formed with the compound high molecular compound.

[0031] "Insulating thin line material" can also use what is a single wire rod. Twist a "single wire rod", it is spun, or is used as vocabulary expressing the so-called filament which has not been carried out, and the single element of the long die length is a small diameter and it can be considered that is continuation is shown. In addition, insulating thin line material contains what is not a single wire rod.

[0032] "The product equipped with the coupling parts for optical fibers" as used in the field of this invention is a concept also containing half-finished products.

[0033] In addition, although this invention attaches and explains the name "the product equipped with the coupling parts for optical fibers and its manufacture approach and manufacturing installation, and the coupling parts for optical fibers" on these specifications, the technical thought of this invention cannot be limited to this, and can be applied to a product equipped with the components which have the component which generally has [hypodermic needle / the injection nozzle of an ink jet printer,] micropore, its manufacture approach and a manufacturing installation, and micropore.

[0034] (Work for) The coupling parts for optical fibers are manufactured as follows by electrocasting. the inside of an electrolysis (electrolysis) tub -- a conductor -- it has a base material. the conductor concerned -- to a base material, it adjoins or approaches and insulating thin line material is arranged. the metal which passes a current in a cell and which deposits by electrocasting -- the above -- a conductor -- a base material and insulating thin line material -- a wrap. Then, the above-mentioned insulating thin line material is removed, and an insertion hole is formed. The electrocasting object with which this insertion hole was formed serves as coupling parts for optical fibers.

[0035] Although insulating thin line material is covered with depositing nickel, it can be drawn out simply and certainly also by the comparatively weak force. It is thought that this is because the compatibility of insulating thin line material and the depositing metal and the adhesive property are weak. Especially, insulating thin line material can extract still more easily in what has the deformable property when it pulls. This is considered to be because it to be extended when it pulls, and for an outer diameter to become thin and for a clearance to be formed between the formed insertion holes.
[0036]
[Embodiment of the Invention] This invention is further explained to a detail based on the gestalt of operation shown in the drawing. the cross-section explanatory view and drawing 2 which show the gestalt of 1 operation of the manufacturing installation of the coupling parts for optical fibers which drawing 1 requires for this invention -- the fixture for manufacture -- a conductor -- it is the expansion strabism explanatory view showing the condition of having attached the section and insulating thin line material. in addition, drawing 2 -- setting -- each part material of the fixture for manufacture, and a conductor -- the member supporting the section etc. is omitting illustration.
[0037] Sign S The manufacturing installation which manufactures the coupling parts for optical fibers is shown. This manufacturing installation S is equipped with the cell 1. A cell 1 has a tank part 10 inside, and has formed it in box-like [in which the upper part carried out opening]. The lid installation section 11 which spreads in the method of outside is formed in the rising wood of a cell 1 over the perimeter, and the lid installation section 11 is covered so that a lid 13 may plug up opening of a cell 1.
[0038] The hanging section 12 for hooking and supporting the anode plate section 2 is formed above the tank part 10. The anode plate section 2 is attached in the hanging section 12. The anode plate section 2 puts many nickel balls in a hold object, and is formed. The sign 3 shows the cathode section. The cathode rays 30 for connecting the lead wire 70 mentioned later hang down to the cathode section 3 caudad, and are formed in it.
[0039] The frame 4 for fixture immobilization is held in the interior of a tank part 10. The fixture 5 for manufacture is accumulated and formed in five steps at the frame 4 for fixture immobilization.
[0040] The tank part 10 of a cell 1 is filled up with the electrolytic solution D. The electrolytic solution D is put in so that the anode plate section 2 and the frame 4 for fixture immobilization may be soaked completely. The electrolytic solution D is using what uses nickel amiosulfonate as a principal component with the gestalt of this operation.
[0041] The fixture 5 for manufacture is equipped with the wire rod holddown members 50 and 50 which fix the edge of the insulating thin line material 6. The wire rod holddown members 50 and 50 are formed in two places, the fixture 5 top for manufacture, and the bottom. The guidance blocks 51 and 51 of the wire rod holddown members 50 and 50 which shows the insulating thin line material 6 inside a little at a position are established, respectively. the hold slot 510 of the shape of V character which lets the insulating thin line material 6 pass in each guidance block 51 ... is formed in ten places at equal intervals. Since the location of the insertion hole with which the location of the insulating thin line material 6 is decided by the location in which this hold slot 510 was formed, as a result the optical fiber in the coupling parts for optical fibers is inserted is decided, the configuration and spacing of the hold slot 510 are finished with high precision.
[0042] In the fixture 5 for manufacture, after the insulating thin line material 6 has become it tense, it has stretched. An edge is fixed to the wire rod holddown members 50 and 50, and each insulating thin line material 6 is stretched in the condition of having held in the hold slot 510,510 of the guidance blocks 51 and 51, and having shown around at the position. In the gestalt of this operation, the insulating thin line material 6 is using the extensible single wire rod formed from the nylon whose outer diameter is about 0.126mm. To the fixture 5 for manufacture, ten insulating thin line material 6 is stretched. the insulating thin line material 6 -- the hold slot 510 -- it has installed at intervals of about 0.25mm by ... In addition, the outer diameter of the insulating thin line material 6, the quality of the material, side-by-side installation spacing, etc. are not limited to this. Since the internal configuration of the insertion hole described above according to the shape of an appearance of this insulating thin line material 6 is decided, what has the outer diameter, the highly precise roundness, and highly precise linearity of the insulating thin line material 6 is used.
[0043] the tabular conductor which has necessary thickness among the guidance blocks 51 and 51 -- the section 7 is formed. a conductor -- the section 7 -- a conductor -- a base material is constituted and it is formed by stainless steel. a conductor -- the section 7 -- the insulating thin line material 6 ... is adjoined and it has prepared in the condition of having made it contacting. a conductor -- the other end of the lead wire 70 linked to the cathode rays 30 which the end described above is connected to the necessary location of the section 7.
[0044] (Work for) the fixture for manufacture in which drawing 3 is shown by drawing 2 -- setting -- a conductor -- it is the cross-section explanatory view showing the condition of having deposited the metal so that the section and insulating thin line material might be covered. The approach and operation which manufacture the coupling parts for optical fibers by the above-mentioned manufacturing installation S are explained referring to drawing 1 thru/or drawing

3 .

[0045] First, a necessary current is passed in the cell 1 in the condition which shows in drawing 1 . The electrolytic solution D is electrolyzed by passing a current in a cell 1. and the conductor prepared in the fixture 5 for manufacture -- a metal (it sets in the gestalt of this operation and is nickel) deposits gradually around the section 7. in addition, nickel -- a conductor -- it deposits in almost equal thickness so that the section 7 may be located in the center of abbreviation. and the thing for which electrocasting is continued further -- a conductor -- the amount of the nickel which deposits around the section 7 can be made to increase thereby -- a conductor -- the insulating thin line material 6 which adjoined the section 7 and has contacted ... a conductor -- it is covered with the nickel which deposited with the section 7 (refer to drawing 3).

[0046] As drawing 3 shows, if nickel deposits, electrocasting will be stopped, and the fixture 5 for manufacture is picked out from a cell 1. and a front face covers from the fixture 5 for manufacture to nickel -- having -- the insulating thin line material 6 and a conductor -- the plate which connotes the section 7 is removed and the insulating thin line material 6 is drawn out from this plate. By the insulating thin line material's 6 falling out, and removing it, the coupling parts 8 for optical fibers with which the insertion hole 80 was formed in ten places are formed. Bore polish is given to the insertion hole 80 which removed the insulating thin line material 6 and was able to do it by honing, a supersonic wave, etc. if needed, and it is made to a dimension.

[0047] The coupling parts 8 for optical fibers manufactured by the manufacturing installation S are used for a capillary, a ferrule, and the components for alignment used at the time of the splice of an optical fiber. In addition, drawing 3 attaches and shows the sign 8 of the expedient top of explanation, and the coupling parts for optical fibers, although the insulating thin line material 6 is not yet extracted. moreover, the gestalt of this operation -- setting -- a conductor -- it buried, killed and came out, and it is and the section 7 has united [so-called] with nickel. And machining etc. is performed to the manufactured capillary 8 and a configuration is prepared.

[0048] Although the insulating thin line material 6 is covered with depositing nickel, it can be drawn out simply and certainly also by the comparatively weak force. This is considered to be because it to be extended when it moreover pulls, since the insulating thin line material 6 is a product made of nylon, and for an outer diameter to become [the compatibility of the insulating thin line material 6 and the depositing metal and an adhesive property are weak,] thin and for a clearance to be formed between the formed insertion holes 80.

[0049] In addition, in the experiment, although the insertion hole 80 is formed, when the ease of drawing was investigated not using the insulating thin line material 6 but using the thin line material of a conductor, it was not able to adhere firmly with the metal with which thin line material deposited, and was not able to draw out easily. When the metal with which the thin line material of a conductor deposited, and the reason for adhering firmly are pulled by the strong force by force not certain, before escaping, they have a possibility that the thin line material itself may go out. Since it becomes impossible to extract when it goes out, it becomes a defective in this case. That is, in the case where thin line material is used as a conductor, it is hard to form the insertion hole 80, and since possibility that a defective will moreover be made is high, it is thought that the yield worsens. Therefore, it cannot be said that the thin line material of a conductor is desirable although the insertion hole 80 is formed. However, it does not deny forming the insertion hole 80 by the thin line material of a conductor. Moreover, when it electroforms using both thin line material 7a of the insulating thin line material 6 and a conductor so that it may mention later, with the insulating thin line material 6, thin line material 7a of a conductor can be drawn out, and the insertion hole 80 can also be formed.

[0050] Since according to the manufacturing installation S shown with the gestalt of this operation the coupling parts 8 for optical fibers are manufactured by electrocasting as it described above, an expensive shaping equipment metallurgy mold is not needed in manufacture. Moreover, since there is also no baking process, a lot of energy is not needed, either.

[0051] Moreover, an operator is not asked for advanced workmanship in manufacture of the coupling parts 8 for optical fibers, but the time and effort and time amount concerning manufacture can be mitigated. Such can be carried out and the coupling parts 8 for optical fibers can be made into the thing suitable for mass production which has high productivity.

[0052] Although that to which the electrolytic solution D uses nickel amiosulfonate as a principal component was used in the gestalt of this operation, the electrolytic solution D is not limited to this and chosen according to the class of metal to deposit. As a deposit metal, metals, such as nickel or its alloy, iron or its alloy, copper or its alloy, cobalt or its alloy, a tungsten alloy, and a particle distribution metal, can be raised, for example. Moreover, as the electrolytic solution which deposits the above-mentioned metal, the liquid which uses water solutions, such as a nickel chloride, a nickel sulfate, the first iron of sulfamic acid, the first iron of hoe fluoride, copper pyrophosphate, a copper sulfate, hoe copper fluoride, cay copper fluoride, titanium copper fluoride, alkanol sulfonic acid copper, cobalt sulfate, and sodium

tungstate, as a principal component, for example, or the liquid which made these liquid distribute impalpable powder, such as silicon carbide, tungsten carbide, boron carbide, a zirconium dioxide, CHITSU-ized silicon, an alumina, and a diamond, be used

[0053] Although the metal used for the anode plate section 2 also used the nickel ball in the gestalt of this operation, it does not limit to this and is chosen according to the class of metal to deposit. For example, nickel, iron, copper, cobalt, etc. can be used. Moreover, neither a configuration nor especially structure is also limited.

[0054] In a cell 1, the stirring means for stirring the electrolytic solution D can also be established. As a stirring means, the thing of air to depend for blowing off and the electrolytic solution can be sucked in, and what is again breathed out in a cell, a pivotable impeller (propeller), a supersonic wave, vibration, etc. can be used, for example. However, a stirring means is not limited to these.

[0055] The above-mentioned coupling parts 8 for optical fibers do not limit also being able to manufacture with equipments other than a manufacturing installation S, and manufacturing by the manufacturing installation S.

[0056] a conductor tabular with the gestalt of this operation -- although it was in the condition of having made the insulating thin line material 6 adjoining the section 7, and the case where it electroformed was mentioned as the example and explained, the manufacture approach of the electrocasting object used as the coupling parts for optical fibers is not limited to this.

[0057] Other examples of the electrocasting object used as the coupling parts for optical fibers which can be manufactured are given to below. Drawing 4 thru/or drawing 17 are the cross-section explanatory views showing other examples of the electrocasting object used as the coupling parts for optical fibers which can be manufactured by this invention. In addition, in drawing 4 thru/or drawing 17 , the sign same in an equivalent part identically to what was shown by above-mentioned drawing 1 R> 1 thru/or above-mentioned drawing 3 is attached and shown.

[0058] what is shown in drawing 4 -- a tabular conductor -- the section 7 is adjoined in the insulating thin line material 6 -- making -- a conductor -- in the background of the section 7, a metal is in the condition which formed the masking material M it is made not to deposit, and electroforms. In addition, the part shown with a fictitious outline is the masking material M. The masking material M is removed after a metal deposits.

[0059] what is shown in drawing 5 -- a tabular conductor -- it is in the condition of having made the insulating thin line material 6 adjoining the side front of the section 7, and the both sides on a background, and electroforms.

[0060] what is shown in drawing 6 -- a tabular conductor -- the ** which does not make the insulating thin line material 6 adjoin the side front of the section 7, and the both sides on a background -- a conductor -- it is in the condition which separated from the section 7 a little and was made to approach, and electroforms.

[0061] what is shown in drawing 7 and drawing 8 -- a tabular conductor -- the condition of having made the insulating thin line material 6 approaching one side of the section 7 -- electroforming -- the drawing concerned -- setting -- a conductor -- machining removes the lower part side containing the section 7. In addition, the part shown with a fictitious outline is a part removed by machining.

[0062] what is shown in drawing 9 and drawing 10 -- the both sides of one insulating thin line material 6 -- this insulating thin line material 6 and abbreviation -- two conductors which have the same outer diameter -- the conductor which is a base material -- it machines so that it may electroform in the condition of having made the thin line material 7a and 7a adjoining and the depositing metal may become a perfect circle form. In addition, the part shown with a fictitious outline is a part removed by machining.

[0063] what is shown in drawing 11 -- a conductor -- it is in the condition of having made two insulating thin line material 6 and 6 adjoining the both sides of thin line material 7a, and electroforms.

[0064] what is shown in drawing 12 -- a conductor -- three places of the periphery section of thin line material 7a -- three insulating thin line material 6 -- it is in the condition which ... was made to adjoin, and electroforms.

[0065] what is shown in drawing 13 -- a conductor -- four places of the periphery section of thin line material 7a -- four insulating thin line material 6 -- it is in the condition which ... was made to adjoin, and electroforms.

[0066] what is shown in drawing 14 -- a conductor -- the surroundings of thin line material 7a -- eight insulating thin line material 6 -- it electroforms in the condition of having made ... approaching. in addition, the conductor shown by drawing 14 -- thin line material 7a -- the insulating thin line material 6 -- what has a large outer diameter is used rather than ... a conductor -- by enlarging the outer diameter of thin line material 7a, electrocasting time amount can be shortened from a small thing.

[0067] what is shown in drawing 15 -- many insulating thin line material 6 ... a conductor -- it electroforms in the condition of having arranged almost equally around thin line material 7a. the conductor shown by drawing 15 -- thin line material 7a -- an outer diameter -- the insulating thin line material 6 -- the larger thing than ... is used.

[0068] drawing 16 -- a conductor -- it is in the condition which thin line material 7a and the insulating thin line material

6 were made to adjoin by turns, and put them in order, and electroforms. in addition -- drawing 16 -- both ends -- a conductor -- although the thin line material 7a and 7a is allotted, this does not limit and the insulating thin line material 6 can be allotted to both ends -- carrying out -- a conductor -- thin line material 7a and the insulating thin line material 6 can be allotted to both ends, respectively. in addition -- although especially an array is not limited -- a conductor -- if thin line material 7a and the insulating thin line material 6 are formed by turns, since a deposit of an almost equal metal will be made to the whole, it is more desirable.

[0069] drawing 17 -- a conductor -- it is in the condition which thin line material 7a and the insulating thin line material 6 were made to approach by turns, and put them in order, and electroforms. in addition, drawing 16 described above in drawing 17 -- the same -- both ends -- a conductor -- this is not limited, either, although the thin line material 7a and 7a is allotted.

[0070] Thus, a number, a location to arrange of the insulating thin line material 6 are not limited, the insulating thin line material 6 is only fluctuated at the time of manufacture, and not only a 1 heart type but also the thing of a 2 heart type or the multicore type beyond it (for example, 100 heart type) can be built easily. Moreover, if mutual spacing is narrowed, it can build so that a connector may not enlarge the thing of a multicore type, either. In addition, as each drawing of drawing 4 thru/or drawing 17 showed, in order to electroform, the fixture for manufacture which corresponded, respectively is used. Explanation of this fixture for manufacture was omitted in each drawing.

[0071] The electrical potential difference at the time of electrocasting, the amount of currents, metaled deposit time amount, the temperature of the electrolytic solution, etc. are suitably adjusted according to the class of electrocasting object which it is going to manufacture.

[0072] Drawing 18 is the explanatory view showing the gestalt of 1 operation of the product equipped with the coupling parts for optical fibers concerning this invention. Signs C1 and C2 show the optical connecter which is the product equipped with the coupling parts for optical fibers. Optical connecters C1 and C2 are equipped with the capillaries 8a and 8b which are the coupling parts for optical fibers built by the manufacturing installation S and the manufacture approach which are shown with the gestalt of the above-mentioned implementation. Although optical connecters C1 and C2 were equipped with the capillaries 8a and 8b of 10 heart type in the gestalt of this operation, the capillary used for an optical connecter is not limited to this.

[0073] The capillaries 8a and 8b with which optical connecters C1 and C2 were equipped form the coupling parts for optical fibers in a rectangular parallelepiped configuration by machining, and what cut this further in the direction which intersects perpendicularly with an insertion hole in the center of abbreviation, and was built is used as a pair.

[0074] Moreover, the mark R1 for carrying out the direction to connect to prevent mistakes is given to Capillaries 8a and 8b. Although the gestalt of this operation was shown by a mark R1 preparing the coloring section, a mark R1 is not limited to this. Moreover, a mark can also be prepared in addition to capillary 8a and 8b.

[0075] The optical fiber is inserted and introduced in the insertion hole so that an edge may become the end face and abbreviation flush of Capillaries 8a and 8b.

[0076] The sign A1 shows the alignment adapter for comparing and holding an optical fiber. As marks R1 and R1 suit optical connecters C1 and C2 in the above-mentioned alignment adapter A1, they insert Capillaries 8a and 8b from both sides, respectively, and they are connected by comparing the core of each other with high precision inside this alignment adapter A1.

[0077] (Work for) The coupling parts for optical fibers currently formed in one from the first in this way are divided, and since it compares and comes to connect so that the end face of the capillaries 8a and 8b which cut further and were made may serve as a pair mutually, even if it is the thing of a multicore type, a core can be compared with high precision.

[0078] The above-mentioned capillaries 8a and 8b do not limit also being able to manufacture with equipments other than a manufacturing installation S, and manufacturing by the manufacturing installation S.

[0079] Drawing 19 thru/or drawing 28 are the explanatory views showing the optical connecter equipped with the capillary currently formed in the special configuration. Drawing 20 , drawing 22 , drawing 24 , drawing 2626 , and drawing 28 are the explanatory views which looked at the optical connecter from the comparison end-face side of a capillary among these drawings. In addition, in drawing 19 thru/or drawing 28 R> 8, the sign same in an equivalent part identically to what was shown by above-mentioned drawing 18 is attached and shown. Moreover, the explanation which overlaps the part shown by above-mentioned drawing 18 about structure in the following explanation is omitted.

[0080] What the capillary shown by drawing 19 thru/or drawing 28 cut the coupling parts for optical fibers of 10 heart type built by the manufacturing installation S and the manufacture approach which are shown with the gestalt of the above-mentioned implementation in the direction which intersects perpendicularly with an insertion hole in the center of abbreviation, and was built is used as a pair. However, the coupling parts for optical fibers are not limited to the thing of

10 heart type.
[0081] As for the capillaries 8c and 8d shown in drawing 19 and drawing 20 , the crosswise end side is formed in the shape of a semicircle.
[0082] The capillaries 8e and 8f shown in drawing 21 and drawing 22 are formed in the configuration from which a part of superior-horn section by the side of a crosswise end was excised aslant.
[0083] The capillaries 8g and 8h shown in drawing 23 and drawing 24 are formed in the plane in which the crosswise end side carried out the declivity.
[0084] The superior-horn section and the temporal-horn section by the side of a crosswise end are excised aslant, and the capillaries 8i and 8j shown in drawing 25 and drawing 26 are formed in the configuration which has a corner according to this excision side.
[0085] the capillaries 8k and 8l. shown in drawing 27 and drawing 28 -- an abbreviation center section on top -- an insertion hole and abbreviation -- the parallel V groove is formed.
[0086] The special configuration formed in the Capillaries [8k and 8l.] top face the end side of the cross direction of Capillaries 8c, 8d, 8e, 8f, 8g, 8h, 8i, and 8j is a mark for carrying out the direction to connect to prevent mistakes. The optical connecters C1 and C2 shown in drawing 19 thru/or drawing 28 are connected by inserting Capillaries 8c, 8d, 8e, 8f, 8g, 8h, 8i, 8j, 8k, and 8l. from both sides, as a mark suits, and comparing them with high precision in the alignment adapter A1, respectively.
[0087] The part which has the special configuration formed in Capillaries 8c, 8d, 8e, 8f, 8g, 8h, 8i, 8j, 8k, and 8l. the interior of the alignment adapter A1 -- Capillaries 8c, 8d, 8e, 8f, 8g, 8h, 8i, 8j, 8k, and 8l. and abbreviation, if it is made to be substantially inserted without a clearance when it has formed in the same configuration and inserts It acts also as the interior of a proposal for showing Capillaries 8c, 8d, 8e, 8f, 8g, 8h, 8i, 8j, 8k, and 8l. to the position in the alignment adapter A1.
[0088] The above-mentioned capillaries 8c, 8d, 8e, 8f, 8g, 8h, 8i, 8j, 8k, and 8l. do not limit also being able to manufacture with equipments other than a manufacturing installation S, and manufacturing by the manufacturing installation S.
[0089] Since an operation of the optical connecter shown in drawing 19 thru/or drawing 28 is the thing and abbreviation identitas which are shown by above-mentioned drawing 18 , explanation is omitted.
[0090] Drawing 29 is the busy condition explanatory view showing the gestalt of other operations of the coupling parts for optical fibers concerning this invention. Signs 9a and 9b show the components for alignment which are the coupling parts for optical fibers built in the welding connector. The components 9a and 9b for alignment are built by the manufacturing installation S and the manufacture approach which are shown with the gestalt of the above-mentioned implementation. although the components 9a and 9b for alignment omit and show the part by drawing 29 in the gestalt of this operation -- respectively -- ten insertion holes 90a, ..., 90b -- that in which ... was formed is used. However, the coupling parts for optical fibers used as components for alignment are not limited to that in which ten insertion holes are prepared. Sign T shows the electrode which emits welding heat.
[0091] The components 9a and 9b for alignment form in a rectangular parallelepiped configuration by machining what was built by electrocasting, and what cut this further in the direction which intersects perpendicularly with an insertion hole in the center of abbreviation, and was built is used. The end face of the side made by said cutting is turned so that it may poke each other at the time of connection, and each component 9a and 9b for alignment is attached so that it can be used as a pair.
[0092] a welding connector -- the insertion holes 90a, ..., 90b from both the outsides of the components 9a and 9b for alignment ... optical fiber B -- one end of ... inserts -- having -- the insertion holes 90a, ..., 90b -- where the core of each other is compared with high precision in the place which escaped from ..., heat emits from Electrode T -- having -- optical fiber B ... fuses and it connects.
[0093] (Work for) Since the end face of the components 9a and 9b for alignment which divided the coupling parts for optical fibers currently formed in one from the first in this way, considered as the pair, cut, and were made is compared and it connects, even if it is the thing of a multicore type, a core can be compared with high precision.
[0094] Moreover, since it can manufacture easily, the components 9a and 9b for alignment can be made cheap.
[0095] The above-mentioned components 9a and 9b for alignment do not limit also being able to manufacture with equipments other than a manufacturing installation S, and manufacturing by the manufacturing installation S.
[0096] Drawing 30 is the busy condition explanatory view showing the gestalt of other operations of the coupling parts for optical fibers concerning this invention. In addition, although optical fiber B is covered in the covering section and covered, it is usually omitting illustration of the covering section by drawing 30 .
[0097] Signs 9c and 9d show the components for alignment for mechanical splices which are the coupling parts for

optical fibers. It is the thing of 10 heart type built by the manufacturing installation S and the manufacture approach which are shown with components 9for alignment c, and the gestalt of the 9d above-mentioned implementation. However, the coupling parts for optical fibers used as components for alignment are not limited to the thing of 10 heart type.

[0098] The components 9c and 9d for alignment form in a rectangular parallelepiped configuration by machining what was built by electrocasting, and what cut this further in the direction which intersects perpendicularly with an insertion hole in the center of abbreviation, and was built is used.

[0099] Moreover, the mark R2 for carrying out the direction to connect to prevent mistakes is given to the components 9c and 9d for alignment. Although the gestalt of this operation was shown by a mark R2 preparing the coloring section, a mark R2 is not limited to this. Moreover, a mark can also be prepared in addition to components 9for alignment c, and 9d.

[0100] optical fiber B -- the end face whose edges of ... are the components 9c and 9d for alignment, and abbreviation -- it has inserted and introduced in the insertion hole so that it may become flat-tapped.

[0101] The sign A2 shows the alignment RESEKU tuple for comparing and holding an optical fiber. Although the alignment RESEKU tuple A2 is using the metal thing in the gestalt of this operation, the thing made of the product made from a zirconia ceramic and synthetic resin etc. can also be used, for example.

[0102] the optical fibers B, ..., B connected -- as marks R2 and R2 suit ... in the above-mentioned alignment RESEKU tuple A2 in the components 9c and 9d for alignment, respectively, it inserts from both sides, and it connects by comparing the core of each other with high precision inside this alignment RESEKU tuple A2. After comparing, the components 9c and 9d for alignment and the alignment RESEKU tuple A2 fix by welding etc. so that the components 9c and 9d for alignment may not separate from the alignment RESEKU tuple A2.

[0103] In addition, the components for alignment for mechanical splices can also form a side face and a top face in a special configuration like the capillary used with the optical connecter shown by drawing 19 thru/or drawing 28 . in this case, the interior of the alignment RESEKU tuple A2 -- abbreviation -- if it is made to be substantially inserted without a clearance when it has formed in the same configuration and inserts, the part formed in the special configuration will act as the interior of a proposal for showing the components for alignment to the position in the alignment RESEKU tuple A2.

[0104] The above-mentioned components 9c and 9d for alignment do not limit also being able to manufacture with equipments other than a manufacturing installation S, and manufacturing by the manufacturing installation S.

[0105] (Work for) The coupling parts for optical fibers currently formed in one from the first in this way are divided, and since it compares and comes to connect so that a components [which cut further and were made / for alignment / 9c and 9d] end face may serve as a pair mutually, even if it is the thing of a multicore type, a core can be compared with high precision.

[0106] Drawing 31 is the busy condition explanatory view showing the gestalt of other operations of the coupling parts for optical fibers concerning this invention. In addition, although optical fiber B is covered in the covering section and covered, it is usually omitting illustration by drawing 31 .

[0107] Signs 9e and 9f show the components for alignment for mechanical splices which are the coupling parts for optical fibers. It is the thing of 10 heart type built by the manufacturing installation S and the manufacture approach which are shown with components 9for alignment e, and the gestalt of the 9f above-mentioned implementation. However, the coupling parts for optical fibers used as components for alignment are not limited to the thing of 10 heart type.

[0108] The components 9e and 9f for alignment form in a rectangular parallelepiped configuration by machining what was built by electrocasting, an insertion hole and the guide holes 91e and 91f prolonged in the shape of a straight line at abbreviation parallel are formed at a both-ends side, and what cut this further in the direction which intersects perpendicularly with an insertion hole in the center of abbreviation, and was built is used.

[0109] Sign P shows the guide pin inserted in the guide holes 91e and 91f. The screw slot (illustration abbreviation) is formed in the both ends of a guide pin P, and Nuts N and N are screwed. When a guide pin P has an outer diameter a little smaller than the guide holes 91e and 91f and inserts it in the guide holes 91e and 91f, what is substantially inserted in mutually without the clearance is used. The mark R3 for carrying out the direction to connect to prevent mistakes is given to the components 9e and 9f for alignment. A mark can also be prepared in addition to components 9for alignment e, and 9f.

[0110] optical fiber B -- the end face whose edges of ... are the components 9e and 9f for alignment, and abbreviation -- it has inserted and introduced in the insertion hole so that it may become flat-tapped.

[0111] the optical fibers B, ..., B connected -- it connects by inserting guide pins P and P in the guide holes 91e and 91f

with which ... is prepared in the components 9e and 9f for alignment, making Nuts N and N screw in the both ends of the guide pin P projected from the guide holes 91e and 91f, binding tight, sticking the components 9e and 9f for alignment, and comparing the core of each other with high precision. After comparing, it can also fix so that welding etc. may be performed to an end face and the components 9e and 9f for alignment may not separate.

[0112] Moreover, this component for alignment can also form a side face and a top face in a special configuration like the capillary used with the optical connecter shown in drawing 19 thru/or drawing 2828 .

[0113] what shows an operation of the components for alignment shown in drawing 31 by the above-mentioned Fig. 3030 , and abbreviation -- since it is the same, explanation is omitted.

[0114] Although the coupling parts for optical fibers were described above, otherwise, they can also be used for a ferrule. A ferrule can also build that with which the capillary section and a flange were united by machining by depositing many metals. In such a ferrule, since the process which attaches a capillary in a flange is lost, the time and effort at the time of manufacturing is mitigable.

[0115] The vocabulary and expression which are used on these specifications are a thing on explanation to the last, and are not restrictive at all, and there is no intention which excepts the vocabulary and expression of the description described by this specification and its part, and equivalence. Moreover, it cannot be overemphasized within the limits of the technical thought of this invention that various deformation modes are possible.

[0116]

[Effect of the Invention] This invention is equipped with the above-mentioned configuration, and has the following effectiveness. Since the coupling parts for optical fibers concerning this invention, and its manufacture approach and manufacturing installation manufacture the coupling parts for optical fibers using electrocasting, they do not need an expensive shaping equipment metallurgy mold. Moreover, since there is also no baking process, a lot of energy is not needed, either.

[0117] An operator is not asked for advanced workmanship in manufacture, but the coupling parts for optical fibers concerning this invention, and its manufacture approach and manufacturing installation can mitigate the time and effort and time amount concerning manufacture. Such can be carried out and the coupling parts for optical fibers can be made into the thing suitable for mass production which has high productivity.

[0118] Although insulating thin line material is covered with the depositing metal, it can be drawn out simply and certainly also by the comparatively weak force. It is thought that this is because the compatibility of insulating thin line material and the depositing metal and the adhesive property are weak. Especially, insulating thin line material can extract still more easily in what has the deformable property when it pulls. This is considered to be because it to be extended when it pulls, and for an outer diameter to become thin and for a clearance to be formed between the formed insertion holes.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] the metal which deposits by electrocasting -- a conductor -- the coupling parts for optical fibers characterized by having the insertion hole which removed the insulating thin line material covered together with the base material, and was formed.
[Claim 2] a conductor -- the metal which adjoins or approaches and arranges insulating thin line material to a base material and which deposits by electrocasting -- the above -- a conductor -- the manufacture approach of the coupling parts for optical fibers characterized by covering a base material and insulating thin line material, removing the account insulation thin line material of Gokami, and forming an insertion hole.
[Claim 3] the conductor prepared in the cell -- the metal with which a base material deposits by electrocasting -- the above -- a conductor -- the manufacturing installation of the coupling parts for optical fibers characterized by adjoining or approaching and arranging insulating thin line material so that it may be covered together with a base material.
[Claim 4] The product equipped with the coupling parts for optical fibers characterized by having the coupling parts for optical fibers manufactured by the manufacturing installation of the coupling parts for optical fibers manufactured by the manufacture approach of the coupling parts for optical fibers according to claim 1, or the coupling parts for optical fibers according to claim 2, or the coupling parts for optical fibers according to claim 3.

[Translation done.]

* NOTICES *

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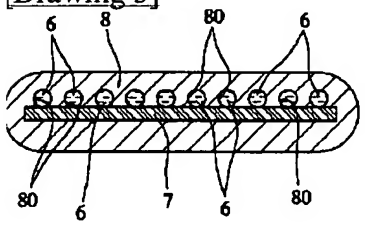
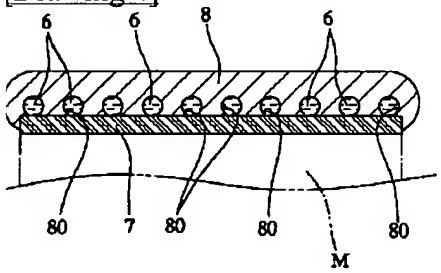
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

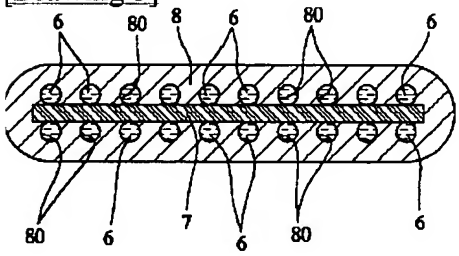
[Drawing 3]



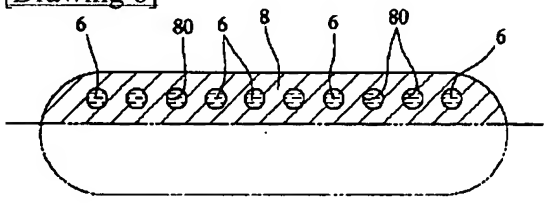
[Drawing 4]



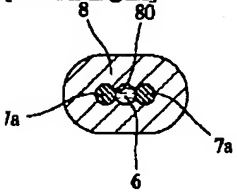
[Drawing 5]



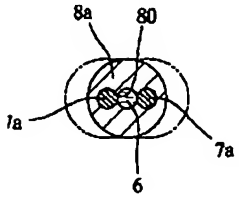
[Drawing 8]



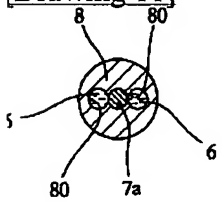
[Drawing 9]



[Drawing 10]

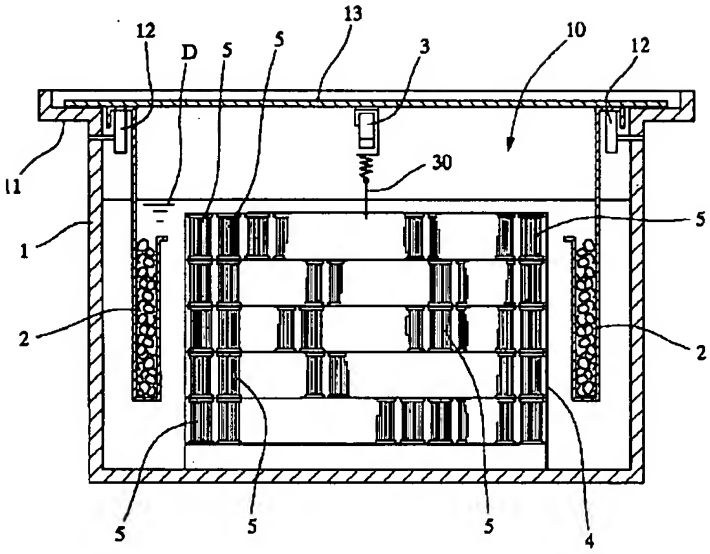


[Drawing 11]

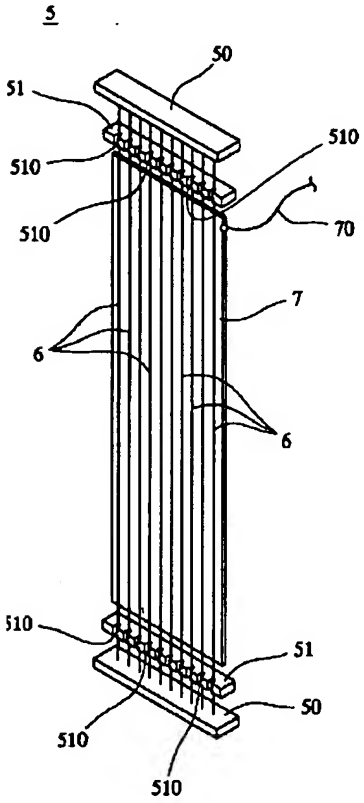


[Drawing 1]

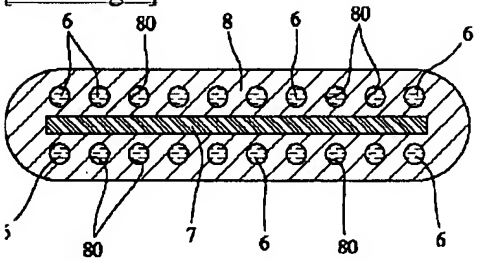
S



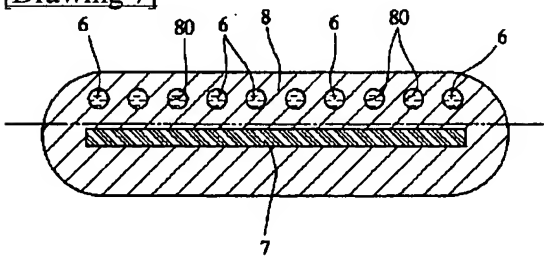
[Drawing 2]



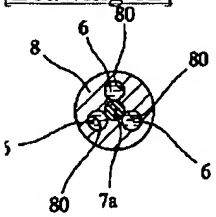
[Drawing 6]



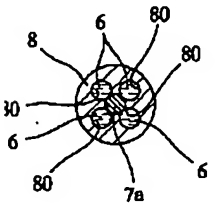
[Drawing 7]



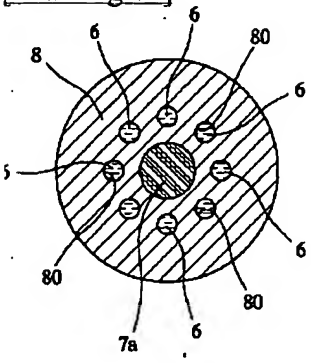
[Drawing 12]



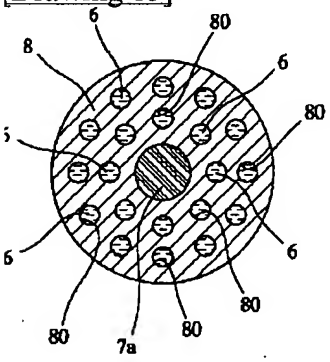
[Drawing 13]



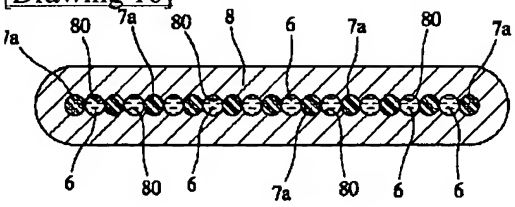
[Drawing 14]



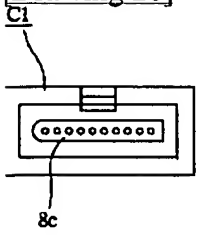
[Drawing 15]



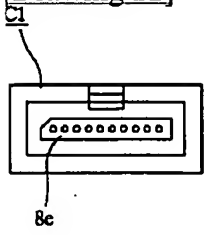
[Drawing 16]



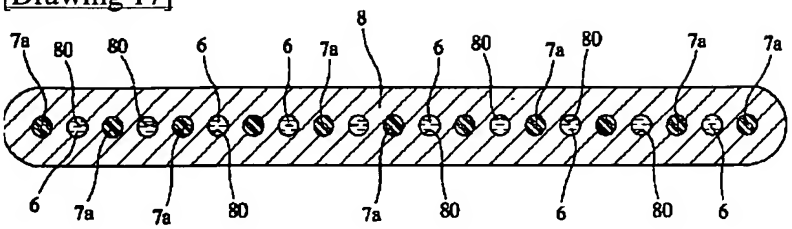
[Drawing 20]



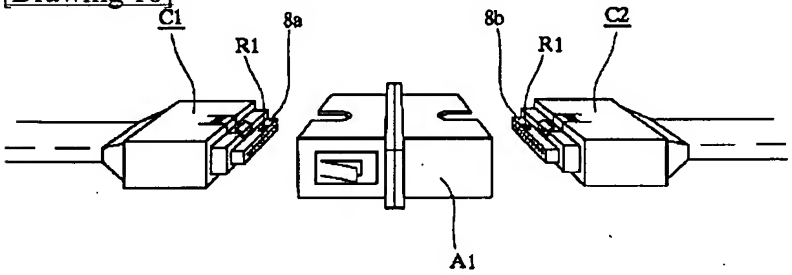
[Drawing 22]



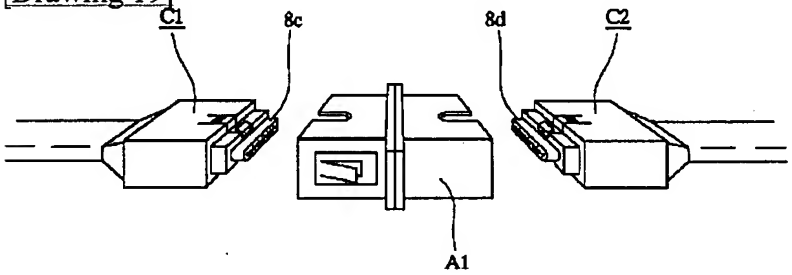
[Drawing 17]



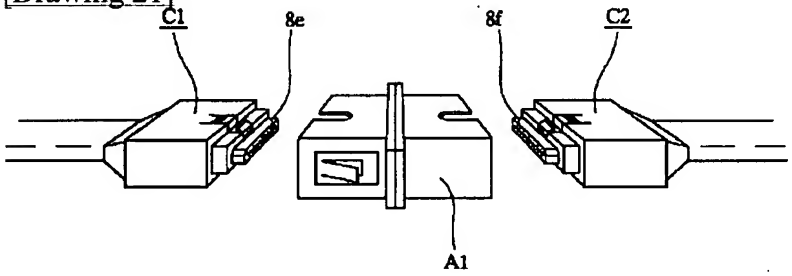
[Drawing 18]



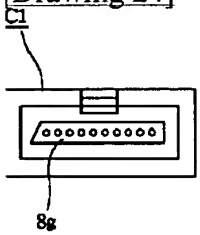
[Drawing 19]



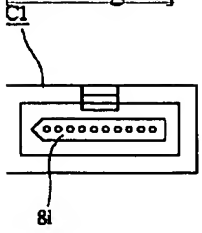
[Drawing 21]



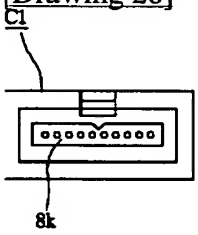
[Drawing 24]



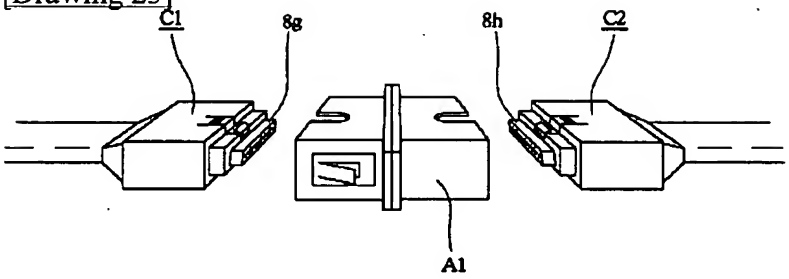
[Drawing 26]



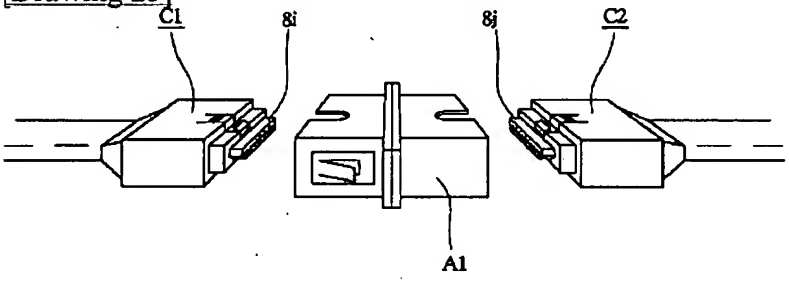
[Drawing 28]



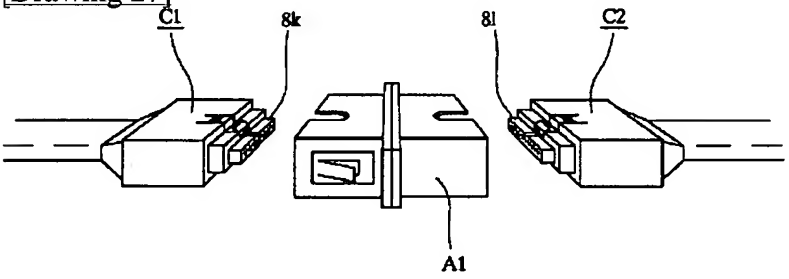
[Drawing 23]



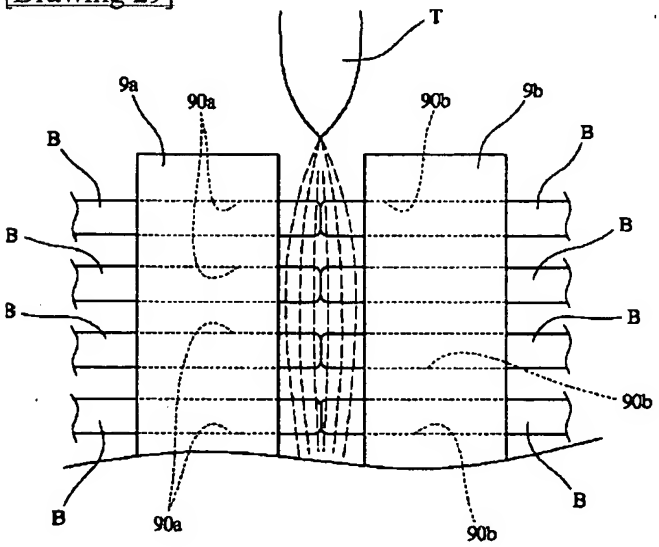
[Drawing 25]



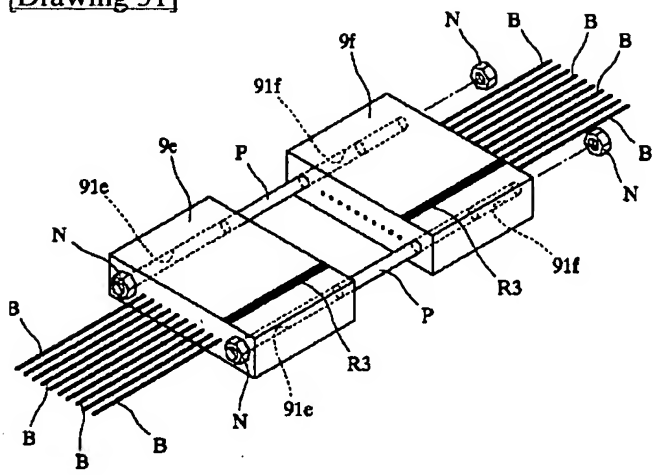
[Drawing 27]



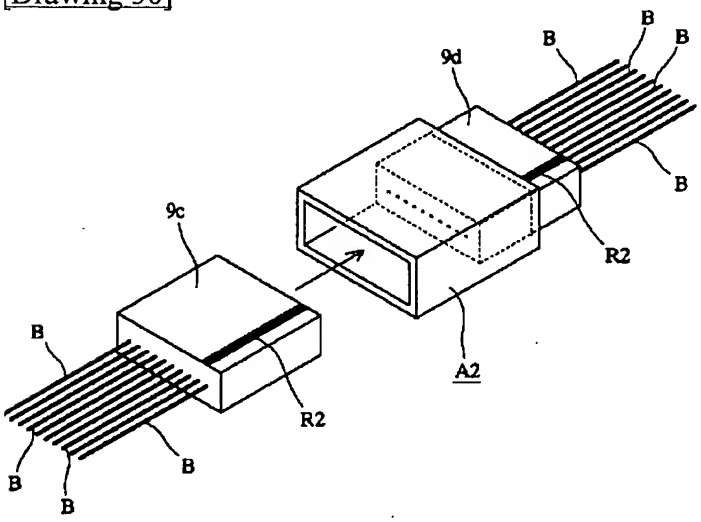
[Drawing 29]



[Drawing 31]



[Drawing 30]



[Translation done.]